

## *Polydora* and Related Genera (Annelida, Polychaeta) from Eniwetok, Majuro, and Bikini Atolls, Marshall Islands

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**ABSTRACT:** In a study of more than 250 specimens of spionid polychaetes collected at Eniwetok, Majuro, and Bikini atolls, Marshall Islands (1956 and 1957) five new and two known species were found.

One of the species (*T. spinosa*) is the type for a new genus, *Tripolydora*, which is closely related to *Polydora*, *Pseudopolydora*, and *Boccardia* by virtue of its modified fifth segment. It is unusual in having branchiae on the fifth segment, and the hooded hooks are trifold and begin on Segment 9. The other new species are *Pseudopolydora corallicola*, *Pseudopolydora pigmentata*, and *Polydora tridenticulata* from coral material, and *Pseudopolydora reishi* from areas of pollution. The known forms, *Pseudopolydora antennata* Claparède and *Polydora armata* Langerhans, are considered in reference to the literature.

The ecologic and systematic positions of the seven species are discussed.

IN A STUDY of a group of spionid polychaetes collected at Eniwetok, Majuro, and Bikini atolls, Marshall Islands, in 1956 and 1957, five polydorids new to science were found and are described herein. In addition, information is provided concerning the natural history and distribution of two known species present. The material was collected by Dr. Donald J. Reish, Department of Biological Sciences, Long Beach State College, Long Beach, California. The field work was made possible by the U. S. Atomic Energy Commission through its Eniwetok Marine Biological Laboratory.

More than 250 specimens were collected, including five new species and *Polydora armata* Langerhans and *Pseudopolydora antennata* (Claparède). The new species belong to *Polydora* Bosc, *Pseudopolydora* Czerniavsky, and a closely related new genus, *Tripolydora*. The new forms include *Polydora tridenticulata*, *Pseudopolydora corallicola*, *Pseudopolydora pigmentata*, *Pseudopolydora reishi*, and *Tripolydora spinosa*.

Among papers providing information concerning polydorid forms from the Marshall Islands area or related ecological regions are those of Hartman (1954) and Okuda (1937). Hartman reported *Polydora* spp. from various parts of Eniwetok Atoll. She noted that one of these resembled *P. armata*. Okuda reported *P. armata* and *Ps. antennata* from coral and related habitats of southern Honshu, Japan.

Collections from the three atolls include material from such diverse habitats as sandy mud to algal materials (including coralline algae), but mainly from coral rocks. Both the ocean and lagoon sides of the atolls were sampled, as were the near, middle, and far sides of the various islands (Fig. 1 and Table 1). The collection periods were from August 22, 1956, to September 7, 1956, and from June 30, 1957, to July 15, 1957 (collections during 1957 at Eniwetok Atoll only). Ecological factors of the collecting areas will be presented in the discussion of the respective species.

The holotypes are in the U. S. National Museum and the remainder of the specimens are at the Eniwetok Marine Biological Laboratory.

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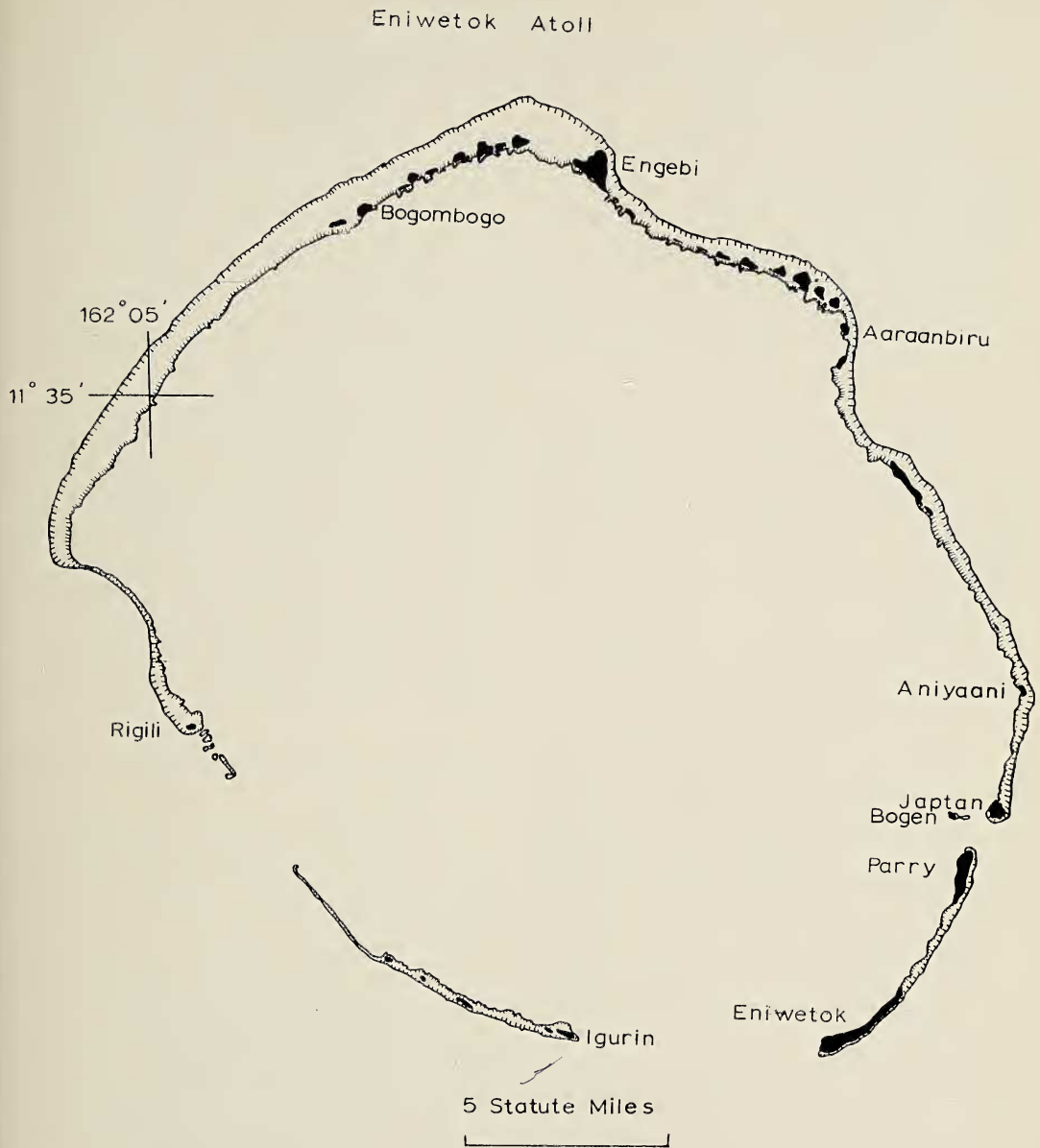


FIG. 1. Eniwetok Atoll, Marshall Islands. Distribution of the species on the various islands is discussed under their respective ecological considerations.

DESCRIPTION AND SYSTEMATICS

*Polydora armata* Langerhans 1880

Fig. 2 (1-6)

This species was found at nine stations and was represented at both Eniwetok and Bikini atolls. The specimens had the characteristic

spines of the fifth and the diagnostic specialized posterior notopodial setae. A 27-segment specimen measuring about 2.5 mm had small branchiae on Segment 7 and well-developed branchiae on Segments 8-12. On all specimens it was difficult to distinguish the branchiae from the dorsal post-setal lobes. Hartman (1954) noted

TABLE 1  
NUMBER OF STATIONS AT WHICH COMPONENT SPECIES OCCURRED

SPECIES	ENIWETOK		MAJURO	BIKINI
	1956	1957	1956	1956
<i>Polydora armata</i> .....	7	0	0	2
<i>Pseudopolydora antennata</i> .....	3	9	3	0
<i>Polydora tridenticulata</i> .....	5	0	0	0
<i>Pseudopolydora corallicola</i> .....	1	0	0	0
<i>Pseudopolydora pigmentata</i> .....	2	0	0	0
<i>Pseudopolydora reishi</i> .....	1	2	0	0
<i>Tripolydora spinosa</i> .....	1	1	0	0

that certain polydorids found in her study were like *P. armata* but had branchiae on more segments than the originally described form. The specimens in this collection generally agree with Langerhans (1880)—gills from 7th to 12th; Fauvel (1927)—gills begin on 7th, 5 to 7 pairs only; and Hartman (1941)—gills begin on 7th, 5 to 6 pairs.

Figure 2 includes a series of drawings of the spines of the fifth segment of *P. armata* which illustrates the appearance of the structure as seen from different angles and at different stages of wear (2, 4, 6). These drawings are paired with comparable figures (1) from Fauvel (1927), (3) from Okuda (1937), and (5) from Ehlers (1905). The third pair of drawings support the synonymy of *Polydora monilaris* Ehlers with *P. armata* (Day, 1954).

*Polydora armata* occurred at Eniwetok Atoll on the following islands: Aniyaani, Japtan, Rigili, Aaraanbiru, and Engebi. It was found at Bikini on Enyu.

*P. armata* at Eniwetok occurred on both the lagoon and ocean sides of the island. It also was collected on the close, far, and middle parts of the island. It was found in coral rocks from reef flats (at one station near the surge zone), on the undersurface of rocks, in old coral heads, and in rocks in reef flat tide pools; at both Eniwetok and Bikini it was collected from coral-line algae identified by Reish as *Porolithon*

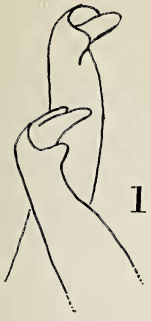
*poncodes* (Heydr.) Foslie. *Polydora armata* has been described in the past from coralline algae, sponge, shells of *Venus* sp. and other lamelli-branches. Okuda (1937:231) says "In the present case the species was found in abundance living commensally with the coral, *Leptastrea purpurea*." Its widespread occurrence in the habitats represented by these collections would indicate a form adapted to a fairly wide range of ecological conditions especially within the limestone habitat.

*Pseudopolydora antennata* (Claparède) 1870  
Fig. 2(7, 8)

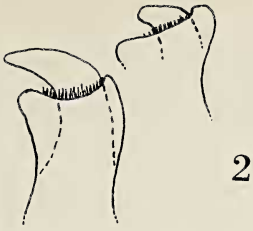
This species was found at 15 stations, 12 on Eniwetok and 3 on Majuro Atoll. By number of specimens it is the dominant form in the collections.

The individuals are attenuated posteriorly, as was noted by Fauvel (1927). A specimen which measured 0.7 mm wide anteriorly was about one half this width at the posterior end. The prostomium is deeply bifurcated, with the lateral lobes long enough in some specimens to be turned to the side like frontal horns. The caruncle extends to the anterior margin of the modified fifth segment on some specimens, to the posterior margin of the sixth in some, and to intermediate positions in other specimens. With limitations, it can be generalized that longer specimens have a more posterior extension of

FIG. 2. 1-6, *Polydora armata*. 1, Setae of fifth (after Fauvel, 1927)  $\times 440$ ; 2, setae of fifth, Eniwetok,  $\times 660$ ; 3, setae of fifth (after Okuda, 1937)  $\times 1000$ ; 4, setae of fifth, Eniwetok,  $\times 660$ ; 5, setae of fifth (*P. monilaris* Ehlers, 1905)  $\times 950$ ; 6, setae of fifth, worn, Eniwetok,  $\times 1200$ . 7, 8, *Pseudopolydora antennata*. 7, Setae of fifth (after Fauvel, 1927),  $\times 430$ ; 8, setae of fifth,  $\times 430$ . 9-12, *Pseudopolydora corallicola*, n. sp. 9, Anterior end,  $\times 75$ ; 10, hooded hook,  $\times 2700$ ; 11, setae of fifth,  $\times 600$ ; 12, pygidium,  $\times 75$ .



1



2



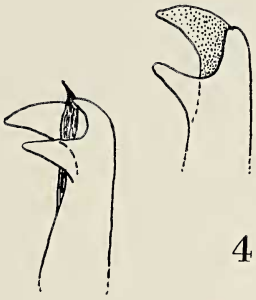
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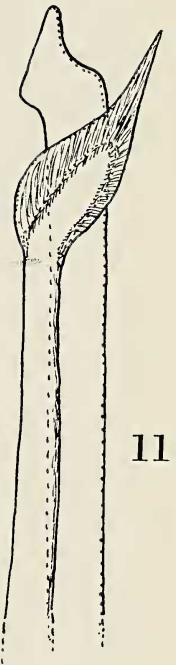
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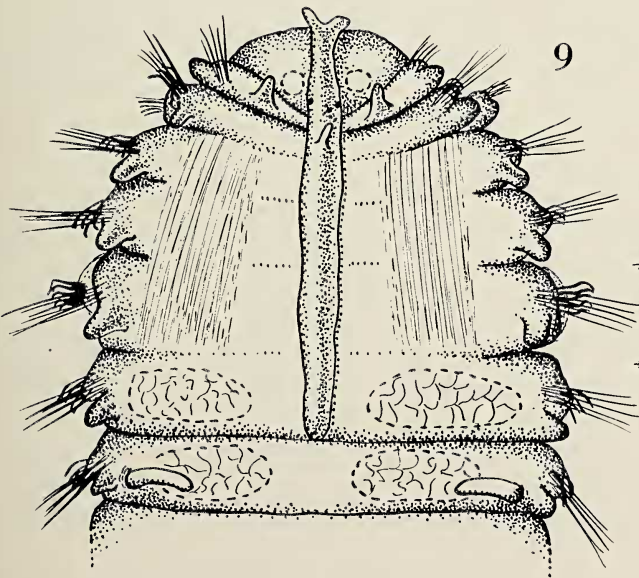
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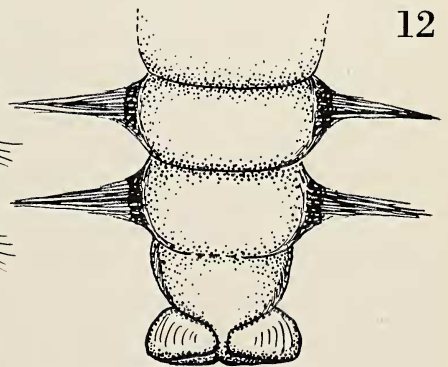
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12



the caruncle. The median nuchal tentacle is located at the level of Segment 1. There are two pairs of eye spots; the anterior eyes are about twice the size of and are farther apart than the posterior pair. On preservation the specimens failed to retain their palps.

In Segment 1 the notopodia and neuropodia are present but not well developed; the former are located in a more dorsal median position than the notopodia of other segments. There are no notosetae.

Segments 2, 3, and 4 have well-developed post-setal lobes with two rows of numerous setae.

Segment 5 from a dorsal view is distinguishable from the preceding and succeeding segments, but it is less modified in this form than in members of the genera *Polydora* and *Boccardia*. The fifth segment is slightly larger than the other segments. It has reduced notopodial and neuropodial lobes. The setae are oriented in two U-shaped or horseshoe-shaped rows, as is typical for the genus. The setae of the fifth have a second tooth (8) not figured by other workers (7); if it is a special characteristic for the Marshall Island forms it seems not significant enough to suggest further taxonomic breakdown.

Segment 7 has the first and a fully-developed pair of branchiae. A complete specimen of 46 segments had 6 abbranchiate, 25 branchiate, and 15 abbranchiate segments in that succession; a complete specimen of 66 segments had numbers of 6, 24, and 36, respectively. The last branchiae are less developed than the largest on the specimen but they are not reduced to small papillae.

Segment 8 has the first neuropodial hooded

hooks. They are bidentate and typical for the group.

The pygidium is cuplike, having a heavy cuff with dorsal and ventral clefts. It is larger in diameter than the posterior-most body segments. It is opaque, somewhat refractile, with a general whitish coloration.

Calcareous particles were found in the gut of many of the worms. Their tubes were heavy-walled, formed of mucus and coral-like material. One specimen from Uliga (Majuro) was expanded dorsally in each segment from 13 through 26; the material within was a pale pink-orange in color and is suggested to be reproductive in nature.

Table 2 provides a comparison of *Pseudopolydora antennata* as described by several workers. In most characteristics the forms described are alike. The table emphasizes the areas of difference.

*P. antennata* was collected at Eniwetok on the islands of Eniwetok and Parry (11 stations). It was also taken at Uliga of Majuro Atoll. This species was found on both the ocean and lagoon sides but, unlike most of the forms in this collection, its habitat is mud, sandy mud, and coarse sand. It is able to survive in polluted areas for it was present in black odoriferous mud 5 ft from a sewer outfall on Parry. Claparède (1870) described it from galleries of wood inhabited by *Teredo* (ship worm). Okuda (1937) collected it from a muddy substratum between crevices of shore rock.

Associated polychaetes at separate stations included *Opisthosyllis brunnea* Langerhans, *Lysidice collaris* Grube, and *Mesochaetopterus*

TABLE 2  
COMPARISON OF CHARACTERISTICS OF *Pseudopolydora antennata*

CHARACTERISTICS	FAUVEL (1927)	ENIWETOK	OKUDA (1937)	FAUVEL (1932)
extension of caruncle.....	to 2nd or 3rd	ant. 5th to post 6th	post 6th	not stated
branchiae.....	begin 7th to 40-50th	begin 7th —to 32 (46) —to 31 (66)	begin 7th —to 90- 100th (104)	begin 7th not stated
size.....	20-30 mm 65-100 segm.	17 mm 74 segm.	30 mm 104 segm.	20-30 mm
second tooth, setae of 5th.....	not indicated	present	not indicated	not indicated

*minuta* Potts. There was no consistent relationship with any one species. (Information on related species was supplied by Dr. Donald J. Reish.)

*Pseudopolydora corallicola* n. sp.

Fig. 2(9-12)

A complete specimen had 36 segments; it was 5.0 mm long and less than 1.0 mm wide. Unlike most polydorids it is somewhat square in appearance from the 5th segment anteriorly. The body is widest at the anterior end near the 5th segment and is attenuated in the posterior third.

The prostomium is damaged but its appearance suggests bifurcation (9). The caruncle extends to the posterior end of Segment 6. A nuchal tentacle is present in the dorsal median line at the level of Segments 1 and 2. There is an anterior pair of eyes present and the usual posterior pair of eyes is represented by a single enlarged eye spot just to the right of the median line. Possibly the left member of the posterior pair has been displaced to the right and the two fused.

Segment 1 is about half as wide as Segment 5. The neuropodium is displaced dorsally to a position comparable to that of the notopodia of segments posterior to Segment 2. The neurosetae project anteriorly. The notopodium is also displaced towards the median dorsal line near the caruncle. There are no notosetae and the post-setal lobes are more cirrate than lobate.

In Segment 2 both the noto- and neuropodia are slightly displaced towards the dorsal midline. Setal lobes and setae are present in both the noto- and neuropodia. Notosetae include long dorsal capillaries and two rows of shorter setae, the most anterior of which are the shortest and have a heavy-winged shape; those of the posterior row, slightly winged but more capillary in nature, are widened in the distal portion.

In Segments 3 and 4 the setal arrangement shows intergradations leading to the typical U-shaped double bundle of setae in Segment 5. Dorsal to these two rows are the well-developed groups of capillary setae.

Segment 5 is the widest part of the body. As previously noted, the setal arrangement is a culmination of the pattern established in suc-

cession through Segments 2-4. The anterior dorsal capillaries are well developed and in general are instrumental in producing a homogeneity of appearance in the anterior segments—typical of *Pseudopolydora* but not of *Polydora* and *Boccardia*. The lower two rows of setae are turned back (the ventral-most setae are displaced to the posterior and then turned dorsally so that the original setae at the dorsal and ventral extremities of a row are now the apical setae in the unjoined or dorsal part of the U-shape); as the two rows orient into the U-shape they produce an inner and an outer row of separate types of setae. The latter are spoon-shaped and, if unworn, the spoon has a sharp basal point. The inner row (posterior row) is made up of heavier stalked setae having an angled distal end terminating in a rounded tip (11). The latter are like the typical modified hooks or spines found in the fifth segment of *Polydora* and *Boccardia* species. There is a neuropodial lobe with associated setae.

Segments 6 and 7 contain large paired internal glands in the same location as glands which the author has seen in stained-sectioned material of *Polydora nuchalis* Woodwick. In the latter species the stain reaction suggested a function related to mucous secretion for the glands.

Segment 7 has full-sized branchiae, which are large in size on succeeding segments through Segment 13; they decrease in size posteriorly but are still present in Segment 21.

Segment 8 has the first neuropodial hooded hooks, as is typical for members of the genus. The hooks are bidentate, with the larger tooth having about a 90° angle with the main setal shaft. The accessory tooth is smaller and closely applied to the main tooth. This relationship occurs in other *Pseudopolydora*, for example *Ps. kempi* Southern (1921). An unusual feature of the hooded hooks is the fenestration of the ends of the teeth (10).

The pygidium is 0.3 mm wide, flared in shape but not broadly, being no greater in diameter than the pre-pygidial segments. It has a definite dorsal notch and a less well-developed ventral notch (12).

Bundles of posterior notopodial spines are found in the posterior third of the body. These



straight, heavy capillary spines extend about 0.3 mm out from the body wall. Individually they are distally attenuated, and as a group they converge to produce a fairly sharp over-all terminal point. Cellular units or glands, columnar in shape, are clustered at the base of the notopodial spines. The bundles of notopodial spines are a dominant feature of the external morphology of this form and are therefore diagnostic in nature. Species of both *Polydora* and *Boccardia* have these posterior notopodial spines, but this is the first of the well-known species of *Pseudopolydora* to have this characteristic.

*Pseudopolydora corallicola* occurred in coral rock on the ocean side of Engebi Island of Eniwetok. It was associated with *Eurythoë complanata* (Pallas).

*Pseudopolydora reishi* n. sp.

Fig. 3(1-3)

*Pseudopolydora reishi* n. sp. was collected at three stations, all on Eniwetok. Two complete specimens measuring 1.2 mm and 2.0 mm had 26 and 30 segments respectively. The prostomium is bifurcated anteriorly; the caruncle extends to the posterior margin of Segment 1 (1). The palpi are short. Eye spots were not present on these specimens. There is no nuchal tentacle.

Segments 1 through 4 are similar in notopodial and neuropodial morphology; however, there is a successional increase in size of the segments from Segments 1 to 4.

Segment 5 is greatly enlarged and is immediately separable morphologically from preceding and succeeding segments. This is an atypical characteristic for members of the genus *Pseudopolydora*. The enlarged 5th has a poorly developed bundle of dorsal capillary setae, with no definite post-setal lobe present. The usual U-shaped double row of setae has been flattened out so that the inner row becomes the dorsal row of setae made up of heavy spines with a modified falcate distal end lacking a sharp point. The ventral row consists of setae with an expanded distal end tipped by a fenestrated or hairy region (2). Setae are reminiscent of those found in other forms, including *Boccardia columbiana* Berkeley (1927) and *B. proboscidea* Hartman (1940), but not those of any other *Pseudopolydora* spe-

cies. The neuropodium of the 5th includes a few, well-developed capillary setae which project some distance from the body wall.

Segment 7 has the first gills which are also present on Segments 8-11. Segment 8 has the first neuropodial hooded hooks. The appearance of the hooded hooks in Segment 8 is characteristic for the indicated genus, although that of Segment 5 and its setal arrangement are not. The hooded hooks are bidentate, with the main tooth large in comparison to the accessory tooth. The main tooth forms an angle of about 90° with the main shaft.

The pygidium is funnel-shaped, having heavy walls made up of cells or cells and their products oriented to give a striated appearance, with the striations forming parallel, straight lines from the proximal base of the pygidium to the distal edge of the cuff. The dorsal pygidial notch is deeper than the ventral notch (3).

*Pseudopolydora reishi* was found on Eniwetok Atoll at Engebi and Parry islands on the lagoon and ocean sides, respectively. On Parry Island this species was associated with areas of pollution in marine waters, being found at stations located 20 and 150 ft from sewer outfalls; however, on Engebi the collecting area was a region of hard coral rocks in sand not indicated as odoriferous. *Pseudopolydora reishi* was associated with *Phyllochaetopterus ramosus* Willey and *Pseudopolydora antennata* at the 150-ft sewer outfall station, and with *Dodecaceria laddi* Hartman and *Pseudopolydora pigmentata* in the hard coral rocks.

In recognition of his endeavors in collecting the materials discussed in this paper, and because his field of research has included studies of marine pollution and indicator organisms, this form has been named for Dr. Donald J. Reish.

*Pseudopolydora pigmentata* n. sp.

Fig. 3(4-6)

*Pseudopolydora pigmentata* n. sp. was found at two stations on Eniwetok. Only incomplete specimens were available. One specimen with 16 segments measured 1.6 mm. The prostomium of the specimen was slightly damaged but the anteriorly rounded prostomium was intact (4). The caruncle reaches to the anterior margin of Segment 2; however, the segmental furrow be-

tween Segment 1 and 2 is displaced posteriorly (on the dorsal median line), so that the caruncle terminates on the level of the middle of Segment 2. There is no nuchal tentacle and only one pair of eyes; the latter are suggested to be the posterior median pair of the two pairs usually present in polydorids.

Segment 1 is small in size compared to Segment 2. There are no notopodial setae; neuro-podial setae are present but the entire parapodial relationship is shifted towards the mid-dorsal line.

Segments 2 and 3 are well developed and typical.

Segment 4 is unusual in its structure and will be discussed with reference to Segment 5.

Segment 5 is modified although in over-all appearance it resembles the preceding and succeeding segments, as is typical for the genus. There is a bundle of dorsal anterior capillary setae, but there is no well-developed post-setal lobe. The modified setae are strong, falcate hooks with a characteristic lined appearance (5). There are four on each side. The accessory setae are limbate. There is a well-developed neuropodium. Segment 4 shows an intergradation between the setae of Segments 3 and 5. In Segment 4 these setae are falcate, but have a thinner shaft and sharper point than those of Segment 5: they show the characteristic lined appearance. There are three on the right side of the segment and four on the left. These setae are comparable to the posterior row of winged setae of Segment 3. This is the most marked development of modified setae in Segment 4 of known polydorids.

Segment 6 has a pair of small branchiae; the branchiae increase in size on Segment 7, and are full sized on Segment 8. They are present on all the other segments of the 16 segment specimen.

The neuropodial hooded hooks first appear on Segment 8. They are bidentate; the free point of the accessory tooth is very small compared to that of the main tooth (6).

The specimen is named for the well-developed dorsal pigmentation. It has paired brown pigment stripes on the dorsal surface of each segment from Segments 2-13. In some of the anterior segments there are two pairs of stripes.

*Pseudopolydora pigmentata* occurred in hard coral rocks from the lagoon side of Eniwetok and Engebi islands of Eniwetok Atoll. At Eni-

wetok it was associated with *Opisthosyllis brunnea* Langerhans, and at Engebi with *Dodecaceria laddi* Hartman and *Pseudopolydora reishi*.

### *Polydora tridenticulata* n. sp.

Fig. 4(1-5)

*Polydora tridenticulata* n. sp. was collected at five stations, all on Eniwetok Atoll. A complete specimen of 64 segments measured 9.0 mm in length and 0.7 mm at the widest part. In general shape the worm tapers toward the posterior end.

The prostomium is bifid and continues posteriorly as a well-developed caruncle to the posterior margin of Segment 3. There is no nuchal tentacle and the eyes are absent (1).

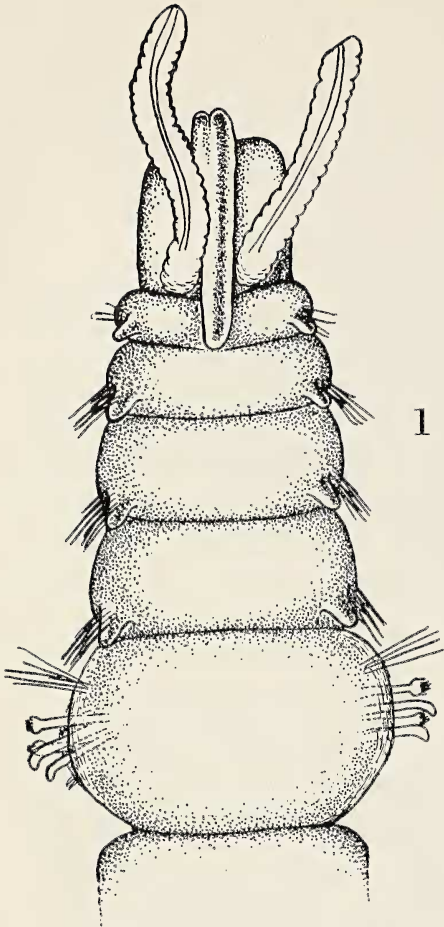
Segment 1 has well-developed notopodial lobes and notosetae moved towards the dorsal median line.

Segment 5 is well-developed and has a definite indentation separating it from Segment 6. It projects anteriorly ventral to Segment 4 and posteriorly dorsal to Segment 6. The dorsal anterior capillary setae project noticeably from the lateral surface of the segment. The large spines of the modified 5th have a heavy main falcate stalk with two lateral teeth placed subterminally on opposite sides of the stalk (2). They provide different images as one views the setae from different angles. At respective angles the lateral teeth (a) are not visible, (b) resemble a rimming flange (3), (c) suggest a single lateral tooth (4), and (d) show the true situation of two lateral teeth on opposite sides subterminal to the main point. On some specimens the lateral teeth are worn off the anterior (first) spine(s), but succeeding spines and the developing posterior embedded spines have sharp lateral teeth. Often in study of polydorids the true appearance of the modified spines of the 5th can be seen only by freeing the developing embedded posterior spines in which all teeth, fibers, and points are unworn. The accessory setae are plumose with a broad terminal end. There is a small bundle of neuropodial setae.

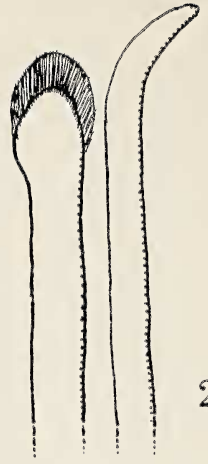
Segment 7 has the first neuropodial hooded hooks. They are bidentate with a well-developed lower tooth.

The branchiae are first present as well-developed structures on Segment 11; however, very small branchiae may be present on Segment 10.

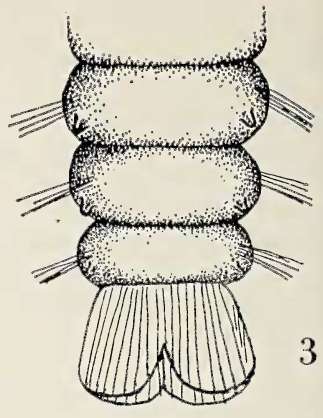




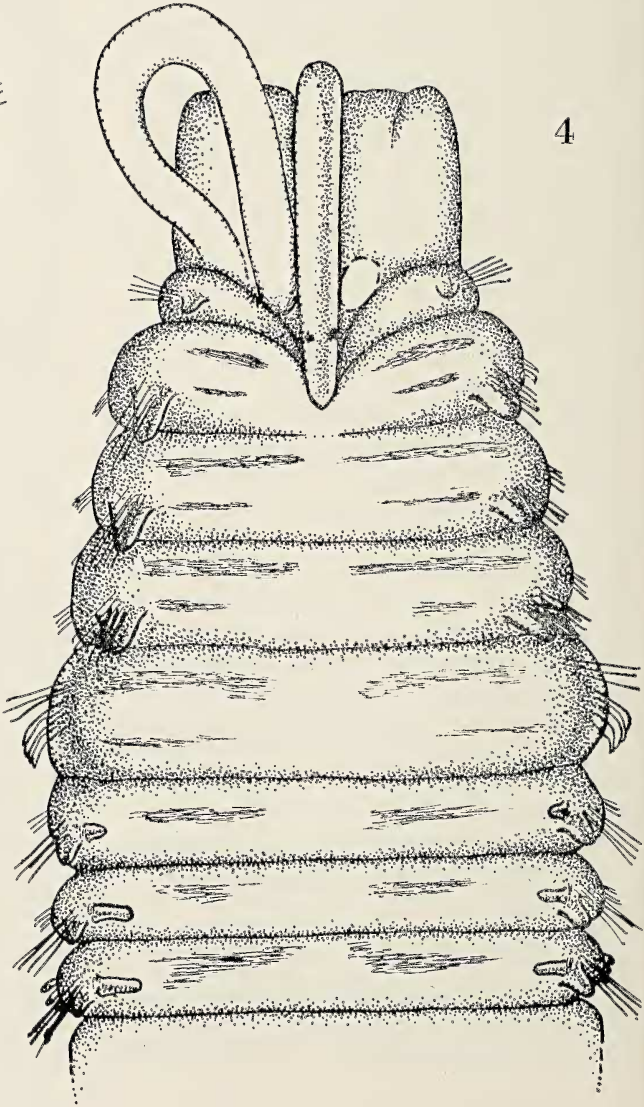
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6

Branchiae are present only as far as Segment 26 on a complete 64-segment specimen.

Posterior notopodial spines are lacking, but a few long thin capillary setae are present in each notopodium.

The pygidium is slightly wider than the last segment. It is not of the flared-disc shape, but has a heavy cuff of refractile tissue. The cuff is as long as  $2\frac{1}{2}$  pre-pygidial segments. The pygidium has a dorsal notch (5).

*Polydora tridenticulata* was found at stations on the lagoon and ocean sides of Japtan, and from the lagoon side of Rigili and Engebi islands of Eniwetok Atoll. This form is an inhabitant of coral rock and by setal structure is likely a boring form. It was associated with *Pseudonereis anomala* Gravier at two stations, and at separate stations with *Palola siciliensis* (Grube) and *Haplosyllis spongicola* (Grube).

*Polydora tridenticulata* is similar to *Polydora anoculata*, *P. giardi*, *P. flava*, and *P. caeca*. It is like the first two in gill arrangement, and similar to the others in appearance of the setae of the fifth. However, unlike the last two, *P. tridenticulata* lacks posterior notopodial spines.

*Tripolydora*, new genus

Type *T. spinosa*, new species

The fifth segment is modified as in *Polydora*, *Pseudopolydora*, and *Boccardia*. The general appearance of the worm and of the fifth segment indicates closer affinities with *Pseudopolydora* than with the other two genera. It differs from all three in that the neuropodial hooded hooks begin on Segment 9 and are tridentate. Branchiae are present on segments.

*Tripolydora spinosa*, n. sp.

Fig. 4 (6-9)

*Tripolydora spinosa* n. sp. was found at two stations, both on Eniwetok. Complete specimens of 25, 25, and 40 segments measured 1.5, 1.6, and 3.0 mm respectively. The body is tapered slightly in the posterior one-third. The rounded prostomium continues posteriorly as a heavy caruncle reaching to the posterior margin of the

third segment (6). The palps are retained on some specimens; on a 25 segment individual they extend to the middle of the body. No eyes are visible.

Segment 1 is poorly developed, lacking notosetae and post-setal lobes. The neuropodium has shifted towards the dorsal midline, and the entire segment is but a vestige compared to Segment 2 and succeeding segments.

Segment 2 has the first branchiae, which are present also on Segments 3, 4, and 5 in a reduced size. Fully-developed branchiae begin on Segment 6. The branchiae are present posteriorly on all but a few pre-pygidial segments.

Segment 5 is a modified segment but resembles that of members of *Pseudopolydora* as, in general, it is not quickly separable from the preceding and succeeding segments on the basis of shape, branchiae, and setal components. It does, however, have two or three modified spines on each side. The spines are heavy-shafted, having a semifalcate tooth at one side surrounded by a subterminal flange with a central indentation (7). The neuropodium is well developed, having both setae and a post-setal lobe.

The neuropodial hooded hooks are important diagnostic characteristics with respect to their structure and location. They are tridentate (8); other forms with a modified fifth segment have unidentate or bidentate hooks. These hooks appear first in Segment 9, in a posterior row accompanied by an anterior row of winged setae; the latter are present anteriorly as far as Segment 4 and posteriorly to Segment 10. At the anterior and posterior limits they intergrade with capillary setae.

Posterior notopodial setae are present as a heavy bundle of fine needles in the last 4 segments of a 30-segment specimen (9). The preceding four segments intergrade with the general setal arrangement.

The pygidium is smaller in diameter than the pre-pygidial segment; it has two ventral lappets and two less distinct dorsal lappets. Its shape is not like the flaring cup typical of most

FIG. 3. 1-3, *Pseudopolydora reishi*, n. sp. 1, Anterior end,  $\times 300$ ; 2, setae of fifth,  $\times 1000$ ; 3, pygidium,  $\times 300$ . 4-6, *Pseudopolydora pigmentata*, n. sp. 4, Anterior end,  $\times 250$ ; 5, setae of fifth,  $\times 1000$ ; 6, hooded hooks,  $\times 2400$ .



forms having modified spines in the fifth segment (9).

*Tripolydora spinosa* was found at Eniwetok Atoll on the lagoon side of Rigili in coarse sandlike rock, and on the lagoon side of Bogombogo in beach rock from a high intertidal region. It was associated with *Lysidice collaris* Grube in both areas.

#### DISCUSSION

##### *Geographic and Ecologic*

Hartman (1954:619) said of the Marshall Islands polychaetes, "The annelid fauna of this area clearly has an affinity with fauna from other parts of the Indo-Pacific." Of the known forms in the present collection, *Pseudopolydora antennata* and *Polydora armata*, the following can be said. *Pseudopolydora antennata* has been reported from many parts of the world, including South Africa, the Mediterranean region, the English Channel, and, for the Indo-Pacific, from Krusadai Island, Gulf of Manaar, Indian Ocean, and Japan. *Polydora armata* has been found in all these areas with the exception of Krusadai Island and with the addition of Ceylon. The two species are thus widely and similarly distributed geographically, indicating that they are both cosmopolitan forms in a general pattern; however, they are restricted in ecological distribution. *Pseudopolydora antennata* has been found in sand and mud, in some cases from polluted regions. *Polydora armata* has been found as a boring form closely associated with calcareous materials. These two are representative of the Indo-Pacific fauna but in no way are restricted to that general region. Determination of the endemicity of the new species must await further data.

Reish (1959), in a study of marine pollution in the Los Angeles-Long Beach Harbor area, included *Pseudopolydora paucibranchiata* (Okuda) as one of the indicator organisms. *Pseudopolydora antennata*, as a close relative of the above species and because of its niche, should receive consideration as a possible indicator

organism in any future pollution surveys in areas in which it is endemic.

The bulk of the forms in the present collections were closely associated with calcareous materials. Hartman (1954) stated, "Most of the annelids may be regarded as having a destructive effect on the reef building processes of corals or coralline algae. . . . *Polydora* . . . may perform the same function rasping with the aid of modified setae." In addition to these modified setae of the fifth many polydorids described from calcareous materials have heavy posterior notopodial spines which should be considered as instrumental in any process of mechanical boring. Known forms having these notopodial spines include *Polydora hamata*, *P. caulleryi*, *P. armata*, *P. caeca*, and *P. hoplura*. Additional species described in this paper include *Pseudopolydora corallicola* and *Tripolydora spinosa*.

Hartman (1954) presented a short review of the effect of annelids on coral atolls, in which polychaetes were suggested by one worker to be the most important boring animals in coral rock. In this regard it would be extremely valuable to supplement the past qualitative studies on coral-boring forms with future quantitative studies to better characterize the roles of respective agents in coral destruction and the over-all significance of each.

##### *Systematic*

The generic breakdown of the polydorid forms has been unstable since the late 1800's and at the present time no one arrangement is accepted by all workers.

Bosc (1802) established the genus *Polydora*; in later works Carazzi (1895) introduced the subgenus *Boccardia*, and Mesnil (1896) the separate but closely related genus *Carazzia*. Many subsequent workers accepted an arrangement of subgenera *Polydora* (*Polydora*) and *Polydora* (*Carazzia*) but retained *Boccardia* as a separate genus. Fauvel (1927) treats all three groups as subgenera, as do Okuda (1937) and Berkeley and Berkeley (1952).

Hartman (1959), in her catalog of the poly-

FIG. 4. 1-5, *Polydora tridenticulata*, n. sp. 1, Anterior end,  $\times 200$ ; 2-4, setae of fifth (different views),  $\times 2000$ ; 5, pygidium,  $\times 200$ . 6-9, *Tripolydora spinosa*, n. gen., n. sp. 6, Anterior end,  $\times 150$ ; 7, setae of fifth,  $\times 750$ ; 8, trifold hooded hooks,  $\times 1800$ ; 9, posterior notopodial spines and pygidium,  $\times 150$ .

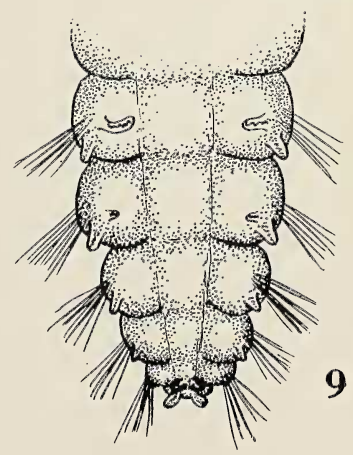
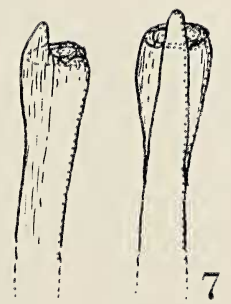
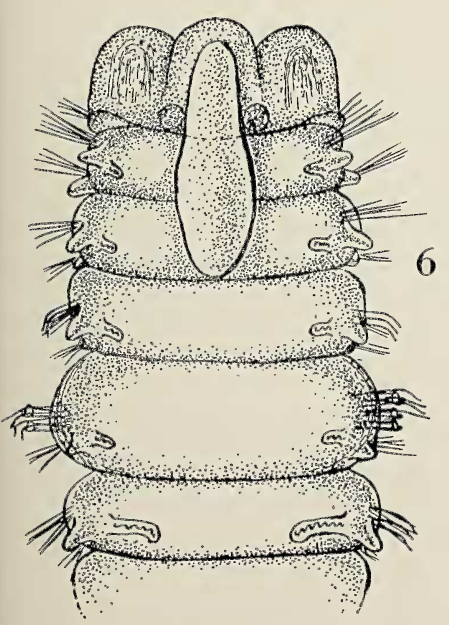
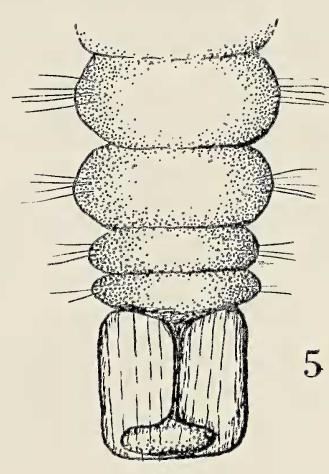
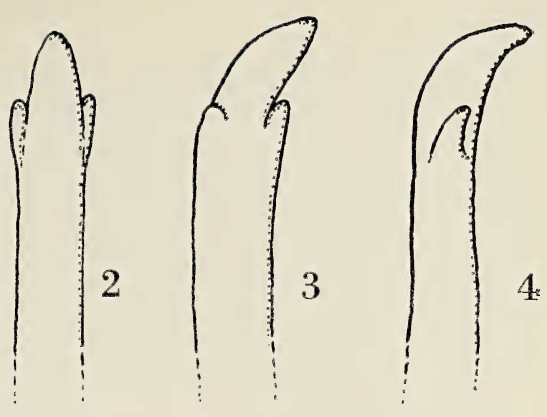
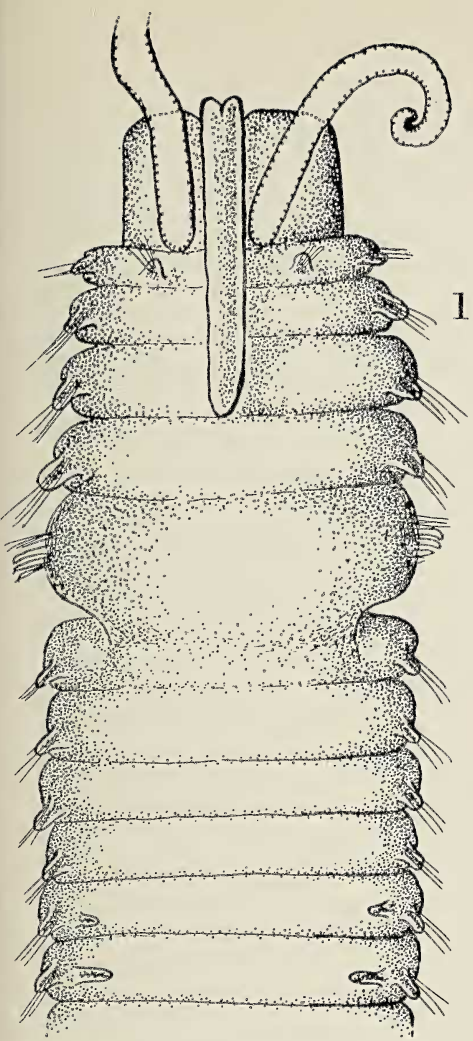




TABLE 3  
CHARACTERISTICS OF POLYDORIDS

GENUS	BRANCHIAE	HOODED HOOKS		MODIFIED 5TH SEGMENT	
		Begin	Shape	Degree of Modification	Setal Arrangement
<i>Polydora</i> .....	post. 5th—absent 5th	7	bifid	great	not U-shaped
<i>Boccardia</i> .....	ant. 5th—absent 5th	7	bifid	great	not U-shaped
<i>Pseudopolydora</i> .....	post. 5th—absent 5th	8	bifid	less	are U-shaped
<i>Tripolydora</i> .....	ant. 5th—present 5th	9	trifid	slightly	not U-shaped

chaetous annelids of the world (Part II), employs separate genera for *Polydora*, *Boccardia*, and *Pseudopolydora*. The latter, from Czerniavsky in 1881, is given priority over *Carazzia* of Mesnil in 1896.

In this paper the arrangement follows that of Hartman. The author is of the opinion that the tendency to accept *Boccardia* as a separate genus on the basis of branchial arrangement and to retain *Pseudopolydora* [= *Carazzia*] as a subgenus is not supportable, for the latter have a specialized 5th segment less modified than that in members of the other two groups; and, quite significantly, the hooded hooks begin not on Segment 7 but on Segment 8. If the separation of one genus is accepted, then both should be accepted. Thus, it would seem that, according to an individual's taxonomic approach, there should be three separate genera or one genus with three subgenera.

The appearance in these collections of members of a new but closely related genus has not helped to clarify the relationships between the respective genera, as Table 3 illustrates.

*Polydora* and *Boccardia* are similar in general appearance and in extreme modification of the 5th segment; however, they vary in branchial arrangement. *Pseudopolydora* and *Tripolydora* are similar in general appearance and modification of the fifth, but vary in general branchial arrangement, setal arrangement in the fifth segment, and segmental appearance of hooded hooks. Both *Boccardia* and *Tripolydora* have branchiae anterior to the 5th, but vary in hooded hooks (segmental appearance and shape); and the latter is the only genus whose members have branchiae on the 5th segment.

With the acceptance of these four genera (or

subgenera) the position of two other species becomes problematical.

In *Polydora commensalis* Andrews (1891) the hooded hooks do not appear until Segments 12–14. This form was placed in *Polydora* because the branchiae begin posterior to the modified fifth; however, they begin on Segment 6 and in most fully described members of this genus the branchiae are first present on Segment 7. *Polydora commensalis* has a highly modified anterior end, an unusual pygidium, and may be sexually dimorphic. The hooded hooks of *Polydora citrona* Hartman (1941) begin on Segment 10 and its prostomium and pygidium are unusual. If one separates the genera (or subgenera) of *Polydora* and *Pseudopolydora* on the basis of appearance of hooded hooks on Segments 7 and 8 respectively, the taxonomic position of *P. commensalis* and *P. citrona* must be re-examined.

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